

# The Stunning World of Jewel Beetles

*Charles L. Bellamy*

In Madagascar during the 1960s and 1970s, French and Malagasy entomologists discovered that certain nest-provisioning wasps of the genus *Cerceris* were particularly fond of small jewel beetles. These wasps would find a beetle on a plant, inject a paralyzing venom, and deposit a single egg on or in the beetle's body before carrying it back to the nest. After hatching, the larva would devour the beetle from the inside out. Inside the wasps' nests, the entomologists found a very large and diverse selection of little beetle mummies. Thousands of

these Malagasy jewel beetles were harvested and sent to the Paris natural history museum. From this collection it is estimated that there are five hundred new species and several new genera awaiting an entomologist with the time to sort and describe the specimens.

Offering one of the most explosive examples of beetle diversity, the island of Madagascar has 744 species of jewel beetles in seventy genera, with literally hundreds of undescribed species. This can be compared to the whole of North America, where there are 762 species in



Known as metallic wood-boring beetles in North America, beetles in the family Buprestidae are called jewel beetles or the equivalent in local languages across most of the world. This copper-hued specimen of *Steraspis amplipennis* was photographed in the Mpumalanga Province of South Africa by C. L. Bellamy.



Many jewel beetles look nothing like a jewel. Instead, they mimic other insects for protection or are covered in hairs (often brightly colored as illustrated by this *Julodis viridipes*) to resemble lichens or other plant parts to avoid predators. Photographed in the Northern Cape Province of South Africa by C. L. Bellamy.

fifty genera, which grows by maybe one new species a year.

Jewel beetles—known in North America as metallic wood-boring beetles—are in the family Buprestidae, which, with nearly fifteen thousand known species, is the eighth-largest beetle family. These beetles can be found in both temperate and tropical habitats and are distributed across all continents.

It is in tropical areas like Madagascar that jewel beetle diversity is centered. Many genera in the northern hemisphere probably originated in more mesic (humid) habitats. Some species eventually moved northward or south-

ward from these areas into unexploited habitats. Both the Nearctic and Palearctic regions (the northern parts of the American and Eurasian land masses, respectively) have similar faunas, including some genera—perhaps even a few species—that occur in both areas and are truly Holarctic. In contrast, the jewel beetle fauna of Australia, like most of the continent's flora and marsupial mammals, is unique, and has obviously diverged from the ancient lineages that were disconnected when the continent separated from Gondwanaland.

Within the Buprestidae, two genera are truly global, with species in each of

the world's major biogeographical regions. The first is the huge genus *Agrilus*, species of which are found on all continents, even on larger Pacific islands such as Fiji and Tahiti. With more than twenty-seven hundred described species, *Agrilus* may be the largest genus in the entire animal kingdom, and there are many other species recognized to be in the genus but not yet formally described. As an example of how large the genus may be, Mexico has 281 known species and at least that many again awaiting scientific description. Despite the diversity of species and worldwide distribution of *Agrilus*, no species are known to be associated with coniferous plants; thus their northern distribution is limited by the presence of angiosperm trees and shrubs in the northern forests. The second genus found on every continent is *Chrysobothris*. This is a much smaller genus, with only about 700 species. Other buprestid genera as large are widely distributed, but missing from at least one major region. Examples are *Anthaxia* (more than 660 species) and *Acmaeodera* (500 species), found in all regions except Australia; and *Sphenoptera* (more than 1,250 species), present only in Africa and Eurasia.

Jewel beetles got their name because a large number of them possess shiny, metallic bodies, often quite striking in color. While many people would look at these and suspect that such an attractive coloration would make them obvious, predators such as birds, lizards, and small mammals may not see beetles the same way we do. An iridescent body may be less visible than black or a flat pastel color on a wet leaf in the filtered sunlight of a humid forest.

Despite their name, some jewel bee-

tles do not look anything like a jewel. In classic Batesian mimicry, some palatable jewel beetles mimic distasteful beetles such as lady beetles (Coccinellidae), net-winged beetles (Lycidae), and fireflies (Lampyridae). Others mimic flies as part of a concept called "speed mimicry," which suggests that predators learn that it takes too much energy to chase a fly and thus will not chase even tasty things that look like flies. Jewel beetles even mimic each other as an example of "numerical mimicry": in the rain forests of Southeast Asia as many as nine species in six different genera are all bright apple-green on the upper surface and deep reddish-purple on the bottom, and about the same size. Each of these species may benefit from the confusion facing predators. Because the species cannot be distinguished from each other, predators will not learn which are the best to eat, thus spreading the number of individuals lost to predation across all the species instead of concentrating it on one. Still other species have wrapped themselves in protective colors and textures or wigs of multi-colored hairs to resemble tree bark, plant galls, and the feces of birds and reptiles.

Throughout their life cycle, jewel beetles have a close relationship with plants. As adults, jewel beetles feed either on foliage or on pollen and nectar. As flower visitors they are valuable as pollinators, sometimes gathering in huge assemblages on patches of nectar-rich flowers. In the late summer months in the mallee areas of arid western and southern Australia, for example, the large adults of *Temognatha* often crowd into patches of sweet, fragrant bloom on the Eucalyptus shrubs. Here as many as twenty-five species of jewel beetles



Jewel beetles fill many ecological niches. The larvae of most species bore into the stems or branches of dead and dying trees and other plants, helping to recycle the nutrients. As adults, they are pollinators of flowers and food for other animals. *Temognatha miranda*, photographed in Western Australia by C. L. Bellamy.

swarm over the masses of flowers.

The larvae are mostly wood borers, chewing through the trunks, branches, and roots of many different trees and shrubs, or down into the woody root crowns of perennial herbs. The larvae typically have the thoracic region expanded on a relatively flattened body, which has given rise to the misnomer “flat-headed wood-borers.” Most species’ larvae feed within the dead or dying portions of their hosts, helping to recycle nutrients and release them for the next generation of plants, and only occasionally do a small number of spe-

cies attack live wood or agriculturally important plants.

Although wood boring is most common, given the range of plants on which larvae might feed it is not surprising that a wide range of feeding strategies exists. Two unusual larval strategies for this family are represented by the external root feeders and the leaf miners. The members of the subfamily Julodinae, found throughout much of the eastern hemisphere except Australasia, are one example of external root feeders. Their larvae live in the soil outside of the host plants. Leaf miners usually have small, flattened larvae that tunnel between the upper and lower layers of many different types of plant leaves. Leaf mining appears to have occurred several times in the Coleoptera, with species known in the leaf beetles (Chrysomelidae) and weevils (Curculionidae), as well as in jewel beetles. Leaf mining probably evolved several times within the jewel beetles, because significant differences are found among the genera that include the leaf-miner species, including different larval morphology, different pupation habits and strategies, and different general host affinities—all within a group of mostly small, triangle-shaped adults.

It is interesting to note that the larval habit of jewel beetle species changes with climate zones. In the extensive boreal forests, many wood-boring species are associated with the diversity of trees and shrubs. In the arid parts of continents, many jewel beetles have adapted by laying eggs at the soil level where the emerging young larvae can work inside the roots, escaping the heat above the ground level. When the perpetually humid tropical habitats are reached,

wood boring is less prevalent. In these damp regions the greatly increased fungal activity in dead wood causes it to rot quickly, leaving fewer opportunities for the wood borers; and the fungal hyphae that thread their way through the decaying wood threaten the larvae in their burrows. This is the habitat that favors the leaf miners as well as those species that work within other types of living plant tissues. For most of these species the larval period is short, and the subsequent pupal stage is spent in a cell hidden in the forest litter, a strategy that does not rely on the persistence of one type of plant material.

Jewel beetles are a fascinating and widespread group that can be found throughout most terrestrial habitats, and that make use of a grand variety of both ancient and modern plant species.

Whether brightly colored or subtly hued, buprestids are part of a diverse group that fulfils important ecological roles such as pollination and assisting in the recycling of dead trees, even—as illustrated by the Malagasy wasps—providing a preferred food supply for other wildlife.

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This stunning example easily shows how jewel beetles got their name. *Afrochoa lepida*, photographed in South Africa by C. L. Bellamy.